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PROCESS FOR PRODUCING RENEWABLE COMBUSTION FUELS AND POWER FUELS
[Verfahren zur Erzeugung von erneuerbaren Brenn- und Kraftstoffen]

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TITLE	(54)	PROCESS FOR PRODUCING RENEWABLE COMBUSTION FUELS AND POWER FUELS
FOREIGN TITLE	[54A]	VERFAHREN ZUR ERZEUGUNG VON ERNEUERBAREN BRENN- UND KRAFTSTOFFEN

Process for producing renewable combustion fuels and power fuels /1*

The invention relates to a process for producing renewable power fuels from biomasses of all type, preferably plants and wood, water and electricity, preferably produced using renewable energy.

The invention can be used to convert biomasses of all type into commercial hydrocarbons such as gasoline, diesel and heating oil, alcohols such as methanol, ethanol, lubricants, plastics of all types and for hydrogen storage and transport, preferably produced using regenerative energy, and thus for integration of renewable energy into existing systems of public power supply, especially in transportation, but also in the material economy of the chemical industry.

In the prior art, fossil fuels, therefore biomass carbonized by natural coalification, are the basis both of the organic material economy and also power supply. In addition, nuclear power and hydro power are used almost exclusively to generate electricity. Some fossil fuels are enhanced, i.e. converted into a form better suited for special applications. Production of power fuels from fossil combustion fuels is common. In doing so liquid fossil fuels are distilled fractionated or converted into gas with water vapor and/or oxygen by gasification. Characteristic of conversion of fossil combustion fuels into power fuels is the change of the material composition necessary in the course of enhancement by decomposition into volatile components and carbon in the form of distillate residues or washing of carbon dioxide out of raw synthesis gases. The decisive disadvantages of the use of fossil fuels are the historically short duration of their availability and carbon dioxide emission to such a degree so that the reproduction

* Numbers in the margin indicate pagination in the foreign text.

force of nature is overtaxed.

Alternatively to using fossil fuels and their enhancement /2
therefore it has been repeatedly suggested that biomass be used for producing combustion and synthesis gas using known gasification processes. Adjustment of the required material composition by separating carbon or carbon dioxide is characteristic of this process of producing synthesis gas from biomass which constitutes the prior art. One example of use of the Winkler process is given by the contribution of E. Nitschke at the KFA symposium "Biomass" on Nov. 12/13, 1981 in Juelich. Analogously to the process for conversion of fossil fuels by gasification, here in the course of producing synthesis gas the required gas mixture must be adjusted by conversion of carbon monoxide and carbon dioxide removal in the course of producing synthesis gas. But it is also pointed out in this contribution that the otherwise conventional process steps of CO conversion and CO_2 washing are eliminated by adding the hydrogen produced by electrolysis of water and the discharge of carbon in the course of material conversion can be avoided.

More recent suggestions have been advanced by H. Kubiak and H.J. Muehlen based on DE-A 19755693.0. An important feature of this patent application is the thermal decomposition of biomass by pyrolysis using an externally heated, solid heat transfer medium into its volatile components and coke. The coke with the heat transfer medium is placed in the furnace and burned. The released heat is used to heat the heat transfer medium and for indirect heating of a "reformer" similar to known steam reformers in which the volatile components of the biomass are converted into a hydrogen-rich gas which is to be used preferably

as fuel for fuel cells.

A summary of the prior art for producing renewable power fuels is given by Thomas Dreier in "Biogenic Fuels - Energy, Economic and Ecological Analysis", IfE Document Series, Vol. 38, 1st Edition 1999, ENERGIE & MANAGEMENT-Verlagsgesellschaft, Herrsching, ISBN 3-933283-13-2.

Burdening the environment with carbon dioxide and the foreseeable /3
depletion of combustion fuels as well as the nonacceptance of nuclear power have led to proposals for introducing as an alternative to fossil fuels hydrogen produced via electrolysis of water as a versatile energy medium. Since hydrogen cannot be transported and stored at ambient pressure and temperature, cryogenic hydrogen systems will be built which maintain cold conditions below the liquefaction temperature of -253 K.

The goal of the invention is technically feasible process engineering suggestions for conversion of renewable energy, preferable wind and hydro power, using renewable raw materials into commercial energy media which are stable under thermodynamic conditions of the environment with respect to pressure and temperature, which avoid the technical risks of cryogenic hydrogen systems and can be operated more economically that the latter.

The goal is achieved by a new combination of processes of biomass use and production of hydrogen and oxygen by electrolysis of water.

The technical object of the invention is to obtain the carbon necessary for chemical bonding of hydrogen from renewable raw materials or other biomasses so that ultimately using known processes of gasification, methanol or Fischer-Tropsch synthesis, but also

hydrogenation from renewable energy and biomass, commercial combustion and power fuels and other hydrocarbon products of the chemical industry can be produced.

As claimed in the invention the goal is reached by the carbon monoxide-hydrogen mixture necessary for synthesis being produced by mixing of hydrogen obtained by electrolysis of water with carbon /4
monoxide, which for its part is produced by coke gasification with oxygen from water electrolysis, the coke being produced at the synthesis location or a location independent thereof by heating or partial oxidation of biomass, preferably using the volatile components of the biomass which are formed to perform tasks of local or regional power supply.

The economic advantage of the invention is that the biomass-produced coke can be transported over great distances to sources of renewable energy which cannot be exploited with conventional methods, for example large hydro forces, or to advantageous nodal points of electric grids, at which there are good prerequisites for producing hydrogen by electrolysis of water so that the hydrogen can be converted at the location of its production into commercial combustion and power fuels which can be transported and stored under ambient conditions.

Embodiment /5

The invention is described below using Figure 1:

At least air-dry biomass [1] is partially oxidized in the device [2] with air [3] at a temperature from 250 to 1000°C. The resulting volatile components [4] are burned in a boiler [5] with air to form conventional combustion gas [6] which is discharged to the environment. The released heat is dissipated to a steam power process [7] and

converted there into electricity [9] using a steam turbine system [8].

The coke [10] produced from biomass in partial oxidation in the device [2] is supplied to a gasification reactor [11] and is gasified there in a first stage [12] with oxygen [13] from hydrogen electrolysis [14] which can be mixed with water vapor or carbon dioxide [15], primarily to form carbon monoxide. In the second process step [16], biocoke [10] and water vapor can advantageously be added again to the hot carbon monoxide to reduce the temperature by the endothermal chemical reaction of the carbon with the gas vapor mixture. The carbon monoxide-rich gas produced in the gasification reactor [11] is mixed in the device [17], optionally after dedusting, with hydrogen [18] from water electrolysis [14] to form methanol synthesis gas and afterwards delivered to catalytic methanol synthesis [19]. The methanol vapors are condensed out of the gas mixture according to the prior art in the cooler [20]. The residual gas which forms in doing so is returned to the process or used externally according to the prior art.

Claim

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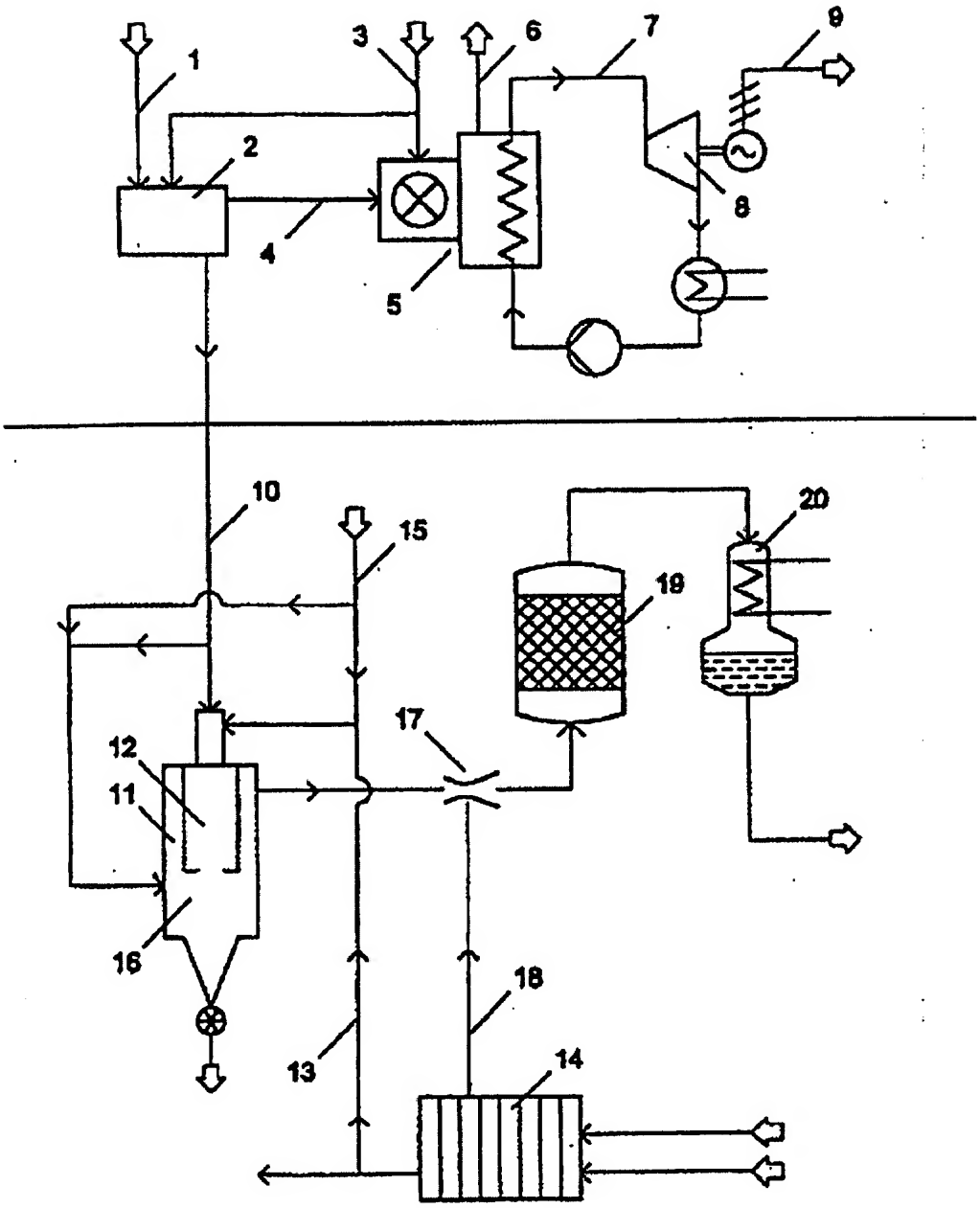
1. Process for producing renewable combustion and power fuels from renewable raw materials or other biomasses, water and renewable energy, characterized in that the carbon monoxide-hydrogen mixture necessary for synthesis is produced by mixing of hydrogen obtained via electrolysis of water with carbon monoxide, which for its part is produced by coke gasification with oxygen from water electrolysis, the coke being produced at the synthesis location or independently thereof by heating or partial oxidation of biomass, preferably using the volatile components of the biomass which are formed, to perform tasks of local or regional power supply.



Figur 1